

Applicants: McBean et al.
Serial No.: 10/718,913
Examiner: Michael A. Brown
Art Unit: 3764

Page 2 of 10

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of claims:

1. (Currently amended) A powered orthotic device for therapeutic movement training augmenting a person's muscular functionality comprising:

a brace adapted to be coupled to a body part of ~~a~~ the person and having a length such that the brace traverses a joint of the person, said brace including a mechanism at least one strap for attaching the brace to the body part of the person;

~~a sensor sensing means, fixed in at least one of the at least one straps such that when said strap is coupled to the body part said sensing means is adapted to be~~ coupled to at least one muscle of the person and wherein in response to an attempt by the person attempting to move the body part, said sensor sensing means senses a surface an electromyographic (EMG) signal of the muscles associated with motion about connected to the joint and provides a sensor signal output in response thereto;

a processor, coupled to the sensor, that determines a desired joint torque from the EMG signal and provides an actuator a-sensor signal based on the sensor signal output in response thereto; and

an actuator coupled to receive the actuator sensor signal from said processor-sensing means and in response to the sensor signal said external

wherein the processor causes the actuator to provide provides a force to the brace in a first direction having a magnitude which is proportional to a magnitude of the sensor signal provided by said sensing means and in a second direction a spring return force, so as to facilitate use of the device in therapeutic movement training wherein the ratio of power delivered by said actuator to the mass of the actuator takes into account all of the elements needed to generate the force.

Applicants: McBean et al.
Serial No.: 10/718,913
Examiner: Michael A. Brown
Art Unit: 3764

Page 3 of 10

2. (Currently amended) The device of Claim 1 further comprising:

~~means for receiving the sensor signal and for sealing the sensor signal by a variable amount; and~~

an active feedback control loop ~~circuit~~ coupled to the processor to control the amount of force applied to the joint by said ~~external~~ actuator.

3. (Currently amended) The device of Claim 2 wherein said active feedback control loop ~~circuit~~ further comprises means for providing a measurement of output torque to ensure an accurate application of force.

4. (Currently amended) The device of Claim 1 further comprising:

a cable drive coupled between said actuator and said brace such that in response to movement of the actuator, said cable drive moves the brace.

5. (Original) The device of Claim 4 further comprising a wheelchair wherein:

at least a portion of said cable drive system is coupled to said wheel chair; and said actuator is disposed such that the mass of said actuator is substantially supported by said wheelchair.

6. (Currently amended) The device of Claim 1 wherein said actuator is ~~corresponds to~~ an electric actuator, a passive actuator, a hydraulic actuator, a pneumatic actuator or a combination thereof.

Claims 7 and 8 (Cancelled)

9. (Currently amended) A powered orthotic device for therapeutic movement training augmenting a person's muscular functionality comprising:

a brace adapted to be coupled to a body part of a ~~the~~ person and having a length such that the brace traverses a joint of the person;

Applicants: McBean et al.
Serial No.: 10/718,913
Examiner: Michael A. Brown
Art Unit: 3764

Page 4 of 10

a sensor sensing means adapted to be coupled to at least one muscle of the person
wherein in response to an attempt by the person attempting to move the body part, said sensor
sensing means noninvasively senses a desired muscular force of the person and provides a sensor
signal output in response thereto;

a processor, coupled to the sensor, that provides an actuator signal based on the sensor
signal output;

an external actuator coupled to receive the sensor signal from said processor sensing
means and in response to the sensor signal said external

wherein the processor causes the actuator to provide provides a force to the brace in a
first direction having a magnitude which is proportional to a magnitude of the sensor signal
provided by said sensing means and in a second direction a spring return force to facilitate use of
the device in therapeutic movement training wherein a ratio of power delivered by said actuator
to the mass of the actuator takes into account all of the elements of the powered orthotic device
needed to generate the force; and

a control means coupled to the processor to aid external the actuator, said control means
including means for making a low impedance measurement of output torque and for providing a
feedback signal to said external actuator to ensure an accurate application of the force in the first
direction provided by said external actuator.

10. (Previously presented) The powered orthotic device of Claim 9 wherein: said brace
comprises a hinge mechanism having first and second hinge portions and first and second straps
coupled to respective ones of the first and second hinge portions wherein said first and second
hinge portions allow the first and second straps to move relative to each other in accordance with
normal movement of a joint which the brace traverses and wherein the device further comprises:

a cable wheel coupled to said brace, said cable wheel having a groove;

a continuous cable coupled to said cable wheel, said continuous cable disposed around
the cable wheel within the groove wherein said continuous cable is retained on one of the first
and second straps such that when the cable is moved, the cable wheel rotates, causing the first
and second straps to move relative to each.

Applicants: McBean et al.
Serial No.: 10/718,913
Examiner: Michael A. Brown
Art Unit: 3764

Page 5 of 10

11. (Previously presented) A powered orthotic device for augmenting a person's muscular functionality comprising:

a brace adapted to be coupled to a body part of the person and having a length such that the brace traverses a joint of the person, said brace comprising first and second straps;

a cable wheel coupled to said brace, said cable wheel having a groove;

a continuous cable coupled to said cable wheel, said continuous cable disposed around the cable wheel within the groove wherein said continuous cable is retained on the second strap such that when the cable is moved, the cable wheel rotates, causing the first and second straps to move relative to each other.

12. (Previously presented) The powered orthotic device of Claim 11 wherein said brace comprises;

a hinge mechanism having first and second hinge portions; and

first and second straps, each of said first and second straps coupled to a respective one of said first and second hinge portions which allow the first and second straps to move relative to each other in accordance with normal movement of the joint which the brace traverses.

13. (Previously presented) The powered orthotic device of Claim 12 wherein said hinge mechanism includes adjustable physical stops or locks which can limit the range of movement of the first strap relative to the second strap.

14. (Previously presented) The powered orthotic device of Claim 11 wherein said cable wheel is provided having a groove and said continuous cable is disposed around the cable wheel within the groove.

15. (Previously presented) The powered orthotic device of Claim 11 further comprising a cable retainer disposed to retain said continuous cable on the second strap.

Applicants: McBean et al.
Serial No.: 10/718,913
Examiner: Michael A. Brown
Art Unit: 3764

Page 6 of 10

16. (Previously presented) The powered orthotic device of Claim 11 wherein said cable 26 is provided having an inner cable portion 26a, which, along certain portions of the cable 26, is surrounded by an outer cable jacket 26b, through which the inner cable portion 26a can slide.

17 (Previously presented) The powered orthotic device of Claim 11 further comprising an actuator coupled to said cable said actuator having force feedback control, which provides the movement of the cable.

18. (Previously presented) The powered orthotic device of Claim 17 further comprising a power source coupled to said actuator.

19. (Previously presented) The powered orthotic device of Claim 17 wherein the power source corresponds to the power source of a wheel chair.

20. (Previously presented) The powered orthotic device of Claim 11 further comprising a sensor disposed to sense signals generated by a person wearing the orthotic device.